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8 including mapped symbols, each mapped symbol corresponding
9 to a discrete point in time; and
10 an interpolation circuit that receives the
11 discrete signal and generates a continuous signal by
12 applying an interpolation function to the discrete signal,
13 the interpolation function operating on the discrete signal
14 such that a frequency response of the continuous signal
15 includes sinusoids having non-zero values at a first set of
16 tones, the first set of tones being a subset of said
17 multiple tones, the non-zero value at each of said first
18 set of tones being a function of a plurality of mapped
19 symbols corresponding to different discrete points in time,
20 the frequency response of the continuous signal also
21 including zero values at a second set of tones, the second
22 set of tones being different from said first set of tones
23 and being another subset of said multiple tones.

2. (Amended) The device of claim 1 wherein the discrete
time instants are defined within the range of 0, T/N , $2T/N$,
..., $T(N-1)/N$, where N is a total number of time instants in
the [time domain symbol duration] predetermined time
interval.

3. (AMENDED) The device of claim 1 wherein the frequency
tones within the allocated tone set are contiguous
frequency tones, and the prescribed time instants are
equally spaced and uniformly distributed over one symbol
duration.

4. (AMENDED) The device of claim 1 wherein the frequency
tones within the allocated tone set are equally spaced
frequency tones, and the prescribed time instants are

4 equally spaced and uniformly distributed over a fraction of
5 one symbol duration.

1 5. (AMENDED) The device of claim 4 wherein a fraction of
2 one symbol duration is defined by $1/L$ where L is the
3 spacing between two adjacent allocated frequency tones in
4 the allocated tone set.

1 6. (AMENDED) The device of claim 1 wherein a total number
2 of discrete time instants is greater than or equal to a
3 total number of frequency tones distributed over the
4 predetermined bandwidth.

1 7. (AMENDED) The device of claim 1 wherein the
2 interpolation circuit further includes a memory for storing
3 the predetermined interpolation functions, and an
4 interpolation function module for retrieving the
5 interpolation functions from the memory and applying the
6 interpolation functions to the discrete signal to generate
7 the continuous signal.

1 8. (AMENDED) The device of claim 7 wherein the
2 interpolation functions comprise a matrix of precomputed
3 sinusoidal waveforms.

1 9. (AMENDED) The device of claim 7 wherein the
2 interpolation functions comprise continuous interpolation
3 functions.

1 10. (AMENDED) The device of claim 1 wherein the mapping
2 circuit replicates the discrete signal of mapped symbols to
3 generate an infinite series of mapped symbols over

4 prescribed time instants covering a time interval from $-\infty$
5 to $+\infty$.

1 11. (AMENDED) The device of claim 10 wherein the
2 interpolation functions comprise sinc interpolation
3 functions, and the interpolation circuit applies the sinc
4 interpolation functions to the infinite series of mapped
5 symbols.

1 12. (AMENDED) The device of claim 1 wherein the data
2 symbols are complex symbols associated with a symbol
3 constellation.

1 13. (AMENDED) The device of claim 1 further including a
2 digital signal processor for implementing the mapping
3 circuit and the interpolation circuit.

1 14. (AMENDED) The device of claim 1 further including a
2 cyclic prefix circuit for receiving the digital signal
3 sample vector from the sampling circuit and prepending a
4 cyclic prefix to the digital signal sample vector.

1 15. (AMENDED) The device of claim 14 wherein the cyclic
2 prefix circuit operates to copy an end portion of the
3 digital signal sample vector and prepend the end portion to
4 a beginning portion of the digital signal sample vector.

1 16. (AMENDED) The device of claim 1 further including a
2 digital to analog converter operable to receive the digital
3 signal sample vector and generate an analog signal for
4 transmission within the communication system.

1 17. A communication system for generating an OFDM signal
2 having allocated frequency tones distributed over a
3 predetermined bandwidth, the communication system
4 comprising:
5 a mapping module that receives data symbols from
6 a symbol constellation and maps the symbols to prescribed
7 time instants in a time domain symbol duration to generate
8 a discrete signal of mapped symbols; and
9 an interpolation module that receives the
10 discrete signal and generates a continuous signal by
11 applying an interpolation function to the discrete signal;
12 wherein the interpolation function operates on
13 the discrete signal such that a frequency response of the
14 continuous signal includes sinusoids having non-zero values
15 at the allocated frequency tones, and zero values at
16 frequency tones other than the allocated frequency tones.

1 18. The communication system of claim 17 wherein the
2 allocated frequency tones are associated with a designated
3 transmitter within the communication system.

1 19. The communication system of claim 17 wherein the
2 allocated frequency tones are contiguous frequency tones,
3 and the prescribed time instants are equally spaced time
4 instants uniformly distributed over one symbol duration.

1 20. The communication system of claim 17 wherein the
2 allocated frequency tones are equally spaced frequency
3 tones, and the prescribed time instants are equally spaced
4 time instants uniformly distributed over a fraction of one
5 symbol duration.

1 21. The communication system of claim 20 wherein a
2 fraction of one symbol duration is defined by $1/L$ where L
3 is the spacing between two adjacent allocated frequency
4 tones.

1 22. The communication system of claim 17 wherein the
2 interpolation function operates on the discrete signal such
3 that values of the continuous signal at the prescribed time
4 instants are equal to the mapped symbols.

1 23. The communication system of claim 17 wherein the
2 interpolation module includes a memory for storing the
3 interpolation function, the interpolation module retrieving
4 the interpolation function from the memory and applying the
5 interpolation function to the discrete signal to generate
6 the continuous signal.

1 24. The communication system of claim 23 wherein the
2 interpolation function comprises a sinc interpolation
3 function.

1 25. A communication system for generating an OFDM signal
2 having allocated
3 frequency tones distributed over a predetermined bandwidth,
4 the communication system
5 comprising:
6 a mapping module that receives data symbols from
7 a symbol constellation and maps the symbols to prescribed
8 time instants in a time domain symbol duration to generate
9 a discrete signal of mapped symbols; and
10 an interpolation module that receives the
11 discrete signal and generates a digital signal sample

12 vector by applying an interpolation function to the
13 discrete signal;
14 wherein the interpolation function operates on
15 the discrete signal such that a frequency response of the
16 digital signal sample vector includes sinusoids having non-
17 zero values at the allocated frequency tones, and zero
18 values at frequency tones other than the allocated
19 frequency tones.

1 26. The communication system of claim 25 wherein the
2 interpolation module further includes a memory for storing
3 the interpolation function, the interpolation module
4 retrieving the interpolation function from the memory and
5 applying the interpolation function to the discrete signal
6 to generate a digital signal sample vector.

1 27. The communication system of claim 26 wherein the
2 interpolation function is a discrete interpolation function
3 comprising a matrix of precomputed sinusoidal waveforms.

1 28. The communication system of claim 27 wherein the
2 interpolation module multiplies the matrix of precomputed
3 sinusoidal waveforms with the discrete signal of mapped
4 symbols over the time domain symbol duration to generate
5 the digital signal sample vector.

1 29. A communication system for generating an OFDM signal
2 having allocated frequency tones distributed over a
3 predetermined bandwidth, the communication system
4 comprising:
5 a mapping module that receives data symbols from
6 a symbol constellation and maps the symbols to prescribed

7 time instants in a time domain symbol duration to generate
8 a discrete signal of mapped symbols; and
9 an interpolation module that receives the
10 discrete signal and generates a continuous signal by
11 applying an interpolation function to the discrete signal;
12 wherein the interpolation function operates on
13 the discrete signal such that values of the continuous
14 signal at the prescribed time instants are equal to the
15 mapped symbols.

1 30. A communication system comprising:
2 a mapping circuit that receives data symbols and
3 maps the symbols to prescribed time instants in a time
4 domain symbol duration to generate a discrete signal of
5 mapped symbols; and
6 an interpolation circuit that receives the
7 discrete signal and generates a continuous signal by
8 applying an interpolation function that operates on the
9 discrete signal such that a frequency response of the
10 continuous signal includes sinusoids having non-zero values
11 at a first set of tones, and zero values at a second set of
12 tones.

1 31. (AMENDED) The communication system of claim 1 wherein
2 the continuous signal comprises an OFDM communication
3 signal and wherein the value of the continuous signal at
4 each of the prescribed time instants is a function of the
5 mapped symbol at said prescribed time instant.

1 32. The communication system of claim 30 wherein the first
2 set of tones are allocated to one communication device
3 within the communication system.

1 33. The communication system of claim 32 wherein the
2 communication device comprises a transmitter.

1 34. The communication system of claim 30 wherein the
2 interpolation circuit is adapted to store the interpolation
3 function.

1 35. The communication system of claim 34 wherein the
2 interpolation function is a sinc interpolation function.

1 36. The communication system of claim 34 wherein the
2 interpolation function is a matrix of precomputed
3 sinusoidal waveforms.

1 37. The communication system of claim 36 wherein the
2 interpolation circuit multiplies the matrix of precomputed
3 sinusoidal waveforms with the discrete signal of mapped
4 symbols over the time domain symbol duration to generate
5 the continuous signal.

1 38. The communication system of claim 30 further
2 comprising a sampling circuit that samples the continuous
3 signal at discrete time instants distributed over the time
4 domain symbol duration to generate a digital signal sample
5 vector.

1 39. The communication system of claim 38 wherein the
2 discrete time instants are defined within the range of 0,
3 T/N , $2T/N$, ..., $T(N-1)/N$, where N is a total number of time
4 instants in the time domain symbol duration.

1 40. The communication system of claim 30 wherein the data
2 symbols are complex symbols associated with a symbol
3 constellation.

1 41. A communication system comprising:
2 a mapping circuit that receives data symbols and
3 maps the symbols to prescribed time instants in a time
4 domain symbol duration to generate a discrete signal of
5 mapped symbols; and
6 an interpolation circuit that receives the
7 discrete signal and generates a digital signal sample
8 vector by applying an interpolation function that operates
9 on the discrete signal such that a frequency response of
10 the digital signal sample vector includes sinusoids having
11 non-zero values at a first set of tones, and zero values at
12 a second set of tones.

1 42. The communication system of claim 41 wherein the
2 interpolation circuit is adapted to store the interpolation
3 function.

1 43. The communication system of claim 42 wherein the
2 interpolation function is a matrix of precomputed
3 sinusoidal waveforms.

1 44. The communication system of claim 43 wherein the
2 interpolation circuit multiplies the matrix of precomputed
3 sinusoidal waveforms with the discrete signal of mapped
4 symbols over the time domain symbol duration to generate
5 the digital signal sample vector.

1 45. A communication system for generating an OFDM signal
2 having a set of frequency tones distributed over a

3 predetermined bandwidth, the communication system
4 comprising:
5 a mapping circuit that receives data symbols from
6 a symbol constellation and maps the symbols to prescribed
7 time instants in a time domain symbol duration to generate
8 a discrete signal of mapped symbols;
9 a DFT circuit that performs a discrete Fourier
10 transform on the discrete signal to generate a frequency
11 domain symbol vector representing a frequency response of
12 the discrete signal at allocated tones;
13 a zero insertion circuit that manipulates the
14 frequency domain symbol vector by inserting zero value
15 symbols at frequency tones other than the allocated tones;
16 and
17 an IDFT circuit that performs an inverse discrete
18 Fourier transform to obtain a digital signal sample vector
19 representing a continuous function.

1 46. The communication system of claim 45 further including
2 a windowing circuit connected between the DFT circuit and
3 the zero insertion circuit, the windowing circuit operable
4 to receive the frequency domain symbol vector, cyclically
5 expand the frequency domain symbol vector and apply a
6 windowing function to the frequency domain symbol vector.

1 47. The communication system of claim 46 wherein the
2 windowing function satisfies the Nyquist zero intersymbol
3 interference criterion.

1 48. The communication system of claim 47 wherein the
2 windowing function is a Fourier transform of a raised
3 cosine interpolation function.

1 49. The communication system of claim 46 wherein a number
2 of allocated tones is greater than a total number of data
3 symbols to be transmitted in the symbol duration.

1 50. A method for reducing a peak-to-average ratio in an
2 OFDM communication signal transmitted by a communication
3 device, the method comprising:
4 providing a time domain symbol duration having
5 equally spaced time instants;
6 allocating a predetermined number of frequency
7 tones to the communication device;
8 receiving as input data symbols to be transmitted
9 by the OFDM communication signal;
10 mapping the data symbols to the equally spaced
11 time instants in the symbol duration to generate a discrete
12 signal of mapped symbols;
13 generating a continuous signal by applying an
14 interpolation function to the discrete signal, the
15 interpolation function operating on the discrete signal
16 such that a frequency response of the continuous signal
17 includes sinusoids having non-zero values at the allocated
18 frequency tones, and zero values at frequency tones other
19 than the allocated frequency tones; and
20 sampling the continuous signal at discrete time
21 instants distributed over the time domain symbol duration,
22 to generate a digital signal sample vector.

1 51. The method of claim 50 wherein the discrete time
2 instants are defined within the range of 0, T/N , $2T/N$, ...,
3 $T(N-1)/N$, where N is a total number of time instants in the
4 symbol duration.

1 52. The method of claim 50 wherein the step of allocating
2 a predetermined number of frequency tones to the
3 communication device further comprises allocating
4 contiguous frequency tones to the communication device.

1 53. The method of claim 50 wherein the step of allocating
2 a predetermined number of frequency tones to the
3 communication device further comprises allocating equally
4 spaced frequency tones to the communication device.

1 54. The method of claim 50 further including the step of
2 replicating the mapped symbols within the symbol duration
3 to generate an infinite series of data symbols over equally
4 spaced time instants covering a time interval from $-\infty$ to $+\infty$
5 after the step of mapping the data symbols.

1 55. The method of claim 54 wherein the step of generating
2 the continuous signal further comprises applying a sinc
3 interpolation function to the infinite series of data
4 symbols.

1 56. The method of claim 50 wherein the discrete signal of
2 mapped symbols includes odd numbered symbols and even
3 number symbols, and further comprises the step of phase
4 rotating each even numbered symbol by $\pi/4$.

1 57. The method of claim 50 further comprising the step of
2 mapping the data symbols to a block of complex data symbols
3 wherein the block of complex data symbols includes odd
4 numbered symbols and even numbered symbols;
5 phase rotating each even numbered symbol by $\pi/4$;
6 and

7 mapping the block of complex data symbols to
8 equally spaced time instants in the symbol duration to
9 generate the discrete signal of mapped symbols.

1 58. The method of claim 50 further comprising the step of
2 offsetting imaginary components of the digital signal
3 sample vector by a predetermined number of samples for
4 producing a cyclic offset in the digital signal sample
5 vector.

1 59. The method of claim 58 further comprising the step of
2 fixing a position of real components of the digital signal
3 sample vector with respect to the imaginary components.

1 60. The method of claim 58 wherein the predetermined
2 number of samples is an integer number of samples.

1 61. The method of claim 58 wherein the predetermined
2 number of samples is a fraction of one sample period.

1 62. The method of claim 50 further comprising the step of
2 prepending a cyclic prefix to the digital signal sample
3 vector.

1 63. The method of claim 62 wherein the step of prepending
2 a cyclic prefix further comprises copying an end portion of
3 the digital signal sample vector and prepending the end
4 portion to a beginning portion of the digital signal sample
5 vector.

1 64. The method of claim 50 wherein the step of allocating
2 a predetermined number of frequency tones includes

3 allocating more tones than a total number of data symbols
4 to be transmitted in the symbol duration.

1 65. The method of claim 50 wherein the interpolation
2 function is a raised cosine function.

1 66. The method of claim 50 further comprising the step of
2 precomputing the interpolation function and storing the
3 interpolation function in a memory.

1 67. A method for reducing a peak-to-average ratio in an
2 OFDM communication signal having a set of tones distributed
3 over a predetermined bandwidth, the method comprising:
4 defining a symbol duration for the OFDM
5 communication signal;
6 defining time instants in the symbol duration;
7 allocating frequency tones from the set of tones
8 to a particular communication device;
9 receiving as input data symbols from a symbol
10 constellation, the data symbols being transmitted by the
11 OFDM communication signal;
12 mapping the data symbols to the time instants to
13 generate a discrete signal in the time domain;
14 generating a digital signal sample vector by
15 applying interpolation functions to the discrete signal
16 such that a frequency response of the digital signal sample
17 vector includes sinusoids having non-zero values at
18 allocated frequency tones, and zero values at frequency
19 tones other than the allocated frequency tones.

1 68. The method of claim 67 wherein the step of allocating
2 frequency tones further includes allocating contiguous

3 tones, and mapping the data symbols to equally spaced time
4 instants distributed over one symbol duration.

1 69. The method of claim 67 wherein the step of allocating
2 frequency tones further includes allocating equally spaced
3 tones, and mapping the data symbols to equally spaced time
4 instants distributed over a portion of one symbol duration.

1 70. The method of claim 67 wherein the data symbols are
2 complex symbols.

1 71. The method of claim 67 wherein the discrete signal
2 includes odd numbered symbols and even number symbols, and
3 further comprises the step of phase rotating each even
4 numbered symbol by $\pi/4$.

1 72. The method of claim 67 further comprising the step of
2 mapping the data symbols to a block of complex data symbols
3 wherein the block of complex data symbols includes odd
4 numbered symbols and even numbered symbols;

5 phase rotating each even numbered symbol by $\pi/4$;

6 and

7 mapping the block of complex data symbols to
8 equally spaced time instants in the symbol duration to
9 generate the discrete signal.

1 73. The method of claim 67 further comprising the step of
2 offsetting imaginary components of the digital signal
3 sample vector by a predetermined number of samples for
4 producing a cyclic offset in the digital signal sample
5 vector.